

## Paper-II : 2229, OPTICS

### Unit-I

**Format's Principle** : Principle of experiments path, the aplanatic points of a sphere and other applications.

**General theory of image formation** : Cardinal points of an system ; general relationship ; thick lenses and lens combinations, telephoto lenses.

**Aberration in images** : Chromatic aberration ; achromatic combination of lenses in contact and separated lenses. Monochromatic aberrations and their reduction ; spherical mirrors and schmidt corrector plates ; oil immersion objective, meniscus lenses.

**Optical instruments** : Entrance and exit pupils, need for a multiple lens eye pieces. Common type eye pieces.

### Unit – II

#### Interference of Light

The principle of superposition ; two slit interference, coherence requirement for the sources, localized fringes in thin films, transition from fringes of equal thickness to those of equal inclination, Newton's rings, Michelson interferometer its uses for determination of wavelength, wavelength difference and standardization of meter. Intensity distribution in multiple beam interference, Fabry-Perot interferometer and etalon. Lummer Gehrke plate, Lloyd's mirror

### Unit – III

#### Diffraction of light

Fresnel diffraction : Half period zones, circular aperture and obstacles ; straight edge, explanation of rectilinear propagation, Zone plate with multiple foci

Fraunhofer diffraction : Diffraction at a slit, a circular aperture and a circular disc, resolution of images ; Rayleigh criterion. Resolving power of a telescope and microscope, outline of phase contrast microscopy.

Diffraction grating : Diffraction at  $N$  parallel slits, plane diffraction grating, concave grating resolving power of grating and prisms.

### Unit – IV

#### Polarization of light

Double refraction and optical rotations : Double refraction in uniaxial crystals, explanation in terms of electromagnetic theory, Malus Law phase retardation

plates, rotation of plane of polarization, origin of optical rotation in liquids and in crystals. Babinet Compensator, Polarimeters and their applications in measurement of specific rotation

Dispersion and Scattering : Theory of dispersion of light, absorption band and anomalous dispersion theory of Rayleigh Scattering .

## Unit - V

### **LASER**

Laser System : Purity of spectral line ; Coherence length and coherence time, spatial coherence of a source ; Einstein's A and B coefficients ; Coherence of induced emissions, conditions for laser action, existence of a metastable state , population inversion by pumping and cavity. He-Ne and Ruby Laser

Application of lasers : Spatial coherence and directionality, estimates of Laser and non linear optics : Polarization P including higher order terms in E and generation of harmonics. Momentum mismatch and choice of right crystal and direction for compensation.

Recent developments in Physics including discussion of Nobel prizes in Physics (no questions to be set in the theory examination).

### **Text Books**

1. Principle of Optics : B. K. Mathur (III<sup>rd</sup> edition)
2. Text book of Optics : Subrahmanyam and Brijlal (S. Chand and Co.)
3. Optics Atomic Physics : Satyaprakash, Ratan Prakash Mandir
4. Optics (in Hindi) Bhandari, Kalra and Kakani

### **Reference Books**

1. Optics : Jenkins and White (McGraw Hill)
2. Text book of Optics : D. P. Khandelwal
3. Universities Optics Vol. I & II : Whittkar and Yarwood
4. Optics : Ajay Ghatak (Tata McGraw Hill)